Chapter 6: Employment Effects

Introduction

The proposed MP&M rule may generate both positive and negative impacts on employment. Facility closures induced by the rule will result in reduced demand for labor and compliance activities at facilities that close, but will also increase employment requirements in facilities that remain open and continue to operate. The regulation will also create a demand for compliance-related equipment and installation, which will also generate new employment requirements.

EPA assumed that all projected facility closures would result in the loss of ***full-time equivalents*** **(FTEs)**.

The MP&M rule may affect overall employment in three ways.

- ***Direct labor requirements***. Direct labor requirements are job losses associated with closures and job gains associated with manufacturing, installing, and operating compliance-related equipment. Direct labor requirements also include labor required to implement pollution prevention activities associated with the rule.[1]

- ***Indirect labor requirements***. Compliance expenditures may increase employment in industries doing business with waste treatment providers. Economists refer to these as ***linked industries***. For example, a firm that manufactures a treatment system will purchase pumps, pipes, and other intermediate goods and services from other firms and sectors of the economy. Employment in these linked industries increases when treatment equipment manufacturers purchase goods and services from them. Closures of MP&M facilities can also lead to reduced requirements for inputs to MP&M industry products, and therefore indirect job losses in the supplier industries.

- ***Induced labor requirements***. Increased employment in the waste treatment industry increases spending on consumer-oriented service and retail businesses. Economists refer to the additional labor demand in the businesses patronized by people working in the waste treatment industry as "induced" labor requirements. Conversely, people who are laid off from MP&M facilities that close due to the rule may spend less, resulting in induced reductions in employment in sectors providing consumer services and products.

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EPA estimates that the MP&M regulation may cause the short-term loss of 5,916 direct full-time equivalent (FTE) jobs due to facility closures, and a short-term gain in direct employment of 4,488 FTEs for individuals necessary to manufacture and install compliance equipment. The regulation will also cause a continuing direct requirement for 286 FTEs per year to operate and maintain the compliance equipment.

The net effect on direct employment of the proposed rule is an estimated 2,575 increase in ***FTE-years***, a measure that reflects both the number and the duration of jobs lost and gained. This number represents an average gain of 172 FTEs per year over the 15 year analysis period.

The analysis assumes that workers losing their jobs due to closures are out of work for an average of one year. If they were out of work less time than that, the gain would be higher.

The net gain in employment represents a very small percentage of the total employment in the MP&M industries. Given the small magnitude of the job gains and job losses compared to overall employment in these industries, EPA did not estimate indirect and induced employment gains and losses due to the rule. EPA also did not estimate employment gains in engineering and consulting services associated with the compliance requirements.

[1] See the *Technical Development Document* for more information on compliance costs.

The rest of this chapter explains how EPA estimated the effects of the proposed MP&M rule on employment. The first section discusses the impact of facility closures, and the second section discusses the new employment associated with the proposed rule. The final section discusses net impacts on employment.

6.1 Job Losses Due to Closures

EPA projects that 199 facilities will close rather than continue operating under the proposed rule, as discussed in Chapter 5. EPA assumed that all employees working at facilities that are projected to close will lose their jobs. The §308 surveys provide the number of employees at each facility, expressed in FTEs. The job losses attributable to the proposed rule are simply the sum of employment at the plants projected to close. EPA did not analyze the job losses that would occur if facilities cut back on production or ceased production of products that required certain processes instead of closing. The projected closure of 199 facilities results in a loss of 5,916 FTEs.

Table 6.1: Job Losses by Subcategory

Subcategory	Estimated Job Losses	% of Jobs in Subcategory
General Metals	1,415	0.01%
Metal Finishing Job Shop	2,065	4.0%
Non-Chromium Anodizing	0	0%
Printed Wiring Board	976	0.7%
Steel Forming & Finishing	952	4.2%
Oily Waste	509	0.01%
Railroad Line Maintenance	0	0%
Shipbuilding Dry Dock	0	0%
All Categories	5,916	0.03%

Source: U.S. EPA analysis.

Job losses equal 0.3 percent of employment in all water discharging MP&M facilities, and 0.03 percent of all employment in the industry. These are very small percentages of all facilities operating in the baseline. The subcategories with the greatest job losses are the Metal Finishing Job Shops (8.4 percent of water dischargers in the subcategory), Steel Forming & Finishing (4.2 percent), and Printed Wiring Boards (2.2 percent). The lost jobs represent 4.0 percent, 4.2 percent, and 0.7 percent of the total employment at water discharging facilities in each subcategory respectively

Job losses due to closures in the General Metals subcategory total 1,415. which represent 0.2 percent of water discharging facilities, and 0.01 percent of all employment at water discharging facilities in the subcategory. All other subcategories have job losses that are less than one percent.

6.2 Job Gains Due to Compliance Requirements

6.2.1 Direct Labor Requirements

Direct labor requirements arise from employment necessary to manufacture, install, and operate equipment that MP&M facilities need to comply with the proposed rule, as well as pollution prevention activities undertaken to comply with the regulation. The following sections discuss labor requirements associated with manufacturing compliance equipment, equipment installation, and operation, respectively.

a. Direct labor requirements for manufacturing treatment systems

EPA estimated the direct labor requirements for manufacturing wastewater treatment systems using three steps:

- Calculate the cost of compliance equipment;
- Estimate the share of the cost of compliance equipment due to labor inputs. This estimate shows how much money goes to employees of equipment manufacturers; and
- Convert the dollars spent on manufacturing employees to a full-time employment equivalent (FTE), based on a yearly labor cost.

❖ ***Treatment system equipment cost***

EPA estimated the cost of manufacturing treatment system equipment for each facility estimated to stay open and to comply with the regulation. This information is found in the facility-level impact analysis (Chapter 5).

The national estimate of capital costs for the proposed rule is $1,339.6 million ($1999).[2] This value includes the purchase cost paid to manufacturers of compliance equipment, and the costs of shipping, installation, insurance, engineering, and consultants. Table 6.2 shows the components of total capital costs for the proposed rule.[3] The basic cost of compliance equipment is $632.3 million.

Table 6.2: Components of Proposed Rule Capital Costs (thousand 1999$, before tax)

Cost Component	Cost[a]
a. Direct capital equipment cost	$632,301.7
b. Shipping (27.4% of a)	$181,520.5
c. Installation labor (9.6% of a)	$93,773.5
d. Total installed direct capital costs (a + b + c)	$907,602.7
e. Indirect costs: insurance, engineering & consultants (47.6% of d)	$432,018.9
Total installed capital costs	$1,339,621.6

a. Excludes costs for baseline and regulatory closures.
Source: U.S. EPA analysis.

❖ ***Labor share of treatment system cost***

The Bureau of Economic Analysis (BEA) calculates ***direct requirements coefficients*** that measure how many dollars of each input are purchased to produce a dollar of a given output.[4] EPA used requirements coefficients for BEA Sector 40, the "Heating, Plumbing, and Fabricated Structural Metal Products Industry," for the employment analysis. MP&M project engineers identified BEA Sector 40 as the industrial sector that most nearly matches the businesses that would make, install, and operate waste treatment systems for MP&M facilities complying with the rule. The inputs into Sector 40 production include intermediate goods, materials, and services, as well as labor. BEA's direct requirements table shows that every dollar of Sector 40 output delivered to final demand requires $0.30632 expended to compensate Sector 40 employees. Multiplying labor's share of output value (30.63 percent) by the value of compliance equipment purchases for the proposed rule ($632.3 million) yields the labor cost of manufacturing treatment system equipment: $193.7 million. EPA assumes that one-third of the equipment purchases and associated labor costs would be incurred in each of the first three years after promulgation of the rule.

❖ ***FTE jobs***

EPA converted the total labor cost to the number of FTE-equivalent jobs by dividing the total labor cost by an estimated yearly labor cost per FTE employee. EPA used the hourly labor rate used in the engineering cost analysis – $29.67 per hour in 1996 dollars. The $29.67 per hour rate includes fringe benefits (e.g., holidays, vacation, and various insurances) and payroll taxes. EPA adjusted this amount to 1999 dollars using the Bureau of Labor Statistics Employment Cost Index for manufacturing of durable goods, to provide an hourly rate in 1999$ of $32.02. The gross 1999$ annual labor cost per FTE position for a 2,000-hour work year is $64,040. EPA estimated that one-time spending on manufacturing treatment system equipment would require 3,024 FTEs. Again, EPA assumed that one third of these FTEs (1,008) would be associated with equipment purchases in each of the first three years after promulgation of the rule.

b. Direct labor requirements for installing treatment systems

EPA's estimate of the direct labor requirements to install treatment system equipment parallels its methodology for analyzing the labor requirements for equipment manufacture.

❖ ***Treatment system equipment installation labor cost***

MP&M project engineers estimate that installation labor costs are seven percent of the total installed direct cost of compliance equipment. The estimated one-time cost of installation labor is $93.8 million for the proposed option. (See Table 6.2.)

❖ ***FTE jobs***

EPA used the loaded hourly labor cost of $32.02 per hour and 2,000 hours per year to convert labor costs to numbers of FTE jobs. Complying facilities will require an estimated 1,464 person-years of full-time employment to install the equipment needed to comply with the proposed rule. This corresponds to 488 FTEs in each of the first three years after promulgation of the rule.

[2] The $1,339.6 million is the sum of one-time outlays for purchasing and installing the capital equipment needed to comply with the proposed rule. This expense is not the annual equivalent of that capital investment. The capital outlay is annualized in the economic impact analysis over a 15-year period. The resulting value, which is part of the total annual cost of compliance, is $112.2 million.

[3] See the *Technical Development Document* for a description of the methods used to estimate capital costs.

[4] See "Benchmark Input-Output Accounts for the U.S. Economy, 1992," in *Survey of Current Business*, July 1997, U.S. Department of Commerce, Bureau of Economic Analysis.

c. Direct labor requirements for operating and maintaining treatment systems

MP&M project engineers estimated that labor costs represent one percent of total compliance operating and maintenance (O&M) costs. For the proposed rule, the labor cost of O&M is $18.3 million per year (1999$), corresponding to 286 FTE positions per year at an hourly rate of $32.02.

d. Total direct labor requirements

The total direct labor requirement for complying with the proposed MP&M rule is the sum of the direct labor requirements of manufacturing, installing, and operating treatment systems. Table 6.3 summarizes the direct labor requirements associated with compliance expenditures under the proposed rule. These requirements include total one-time expenditures to manufacture and install compliance equipment equal to 4,488 FTEs, and continuing requirements for operating and maintenance of 286 FTEs per year.

Table 6.3: Direct Labor Requirements of the Proposed Rule, National Estimates (thousands 1999 Dollars, before tax)

	Total Capital Equipment Cost	Labor Share	Total Labor Cost	FTEs[a]
Year 1				
Manufacturing (1/3 of $632,301)	$210,767	30.63%	$64,558	1,008
Installation labor (1/3 of $93,774)			$31,258	488
1/3 of Annual Operating and Maintenance Cost ($18,288)			$6,095.9	95
Year 1 Total				1,591
Year 2				
Manufacturing (1/3)	$210,767	30.63%	$64,558	1,008
Installation labor (1/3)			$31,258	488
2/3 of Annual Operating and Maintenance Cost			$12,191.9	190
Year 2 Total				1,686
Year 3				
Manufacturing (1/3)	$210,767	30.63%	$64,558	1,008
Installation labor (1/3)			$31,258	488
Annual Operating and Maintenance Cost			$18,287.8	286
Year 3 Total				1,782
Year 4 and Thereafter				
Years 3-15, Total				286

a. Number of jobs calculated on the basis of an average hourly labor cost of $32.02 and 2,000 hours per labor-year.
Source: U.S. EPA analysis, Bureau of Labor Statistics, Bureau of Economic Analysis.

6.2.2 Indirect and Induced Labor Requirements

In addition to direct labor requirements, the proposed MP&M rule may also generate employment through the indirect and induced effects described earlier. Economists use ***multipliers*** to measure indirect and induced input requirements. Multipliers indicate how much a region's economy grows when a dollar is injected into a specific industry at a specific location. When an MP&M facility spends a dollar on treatment equipment, the businesses that make, install, and operate the equipment earn a dollar.

These businesses in turn buy from other suppliers, who in turn buy from still other businesses. In addition, employees in the treatment system industry spend the money they earn on groceries, homes, and other goods and services, thus adding to the impact of that original dollar.

EPA considered a range of multipliers in this analysis to illustrate the possible aggregate employment effects of an MP&M rule. These industry multipliers are averages reflecting both input-intensive activities and activities with relatively few links to other industries. One earlier EPA study used multipliers ranging from 3.5 to 3.9 to estimate employment effects of general water treatment and pollution control activities.[5] A National Utility Contractors Association (NUCA) study of "clean water investments" documented total employment effect multipliers ranging from 2.8 to 4.0.[6] Using the high and low values among multipliers cited in these studies (2.8 to 4.0), EPA estimates that the indirect and induced economic effect of 286 continuing new direct jobs per year would create 801 to 1,144 full-time jobs in the rest of the economy.

EPA is not including a total estimate of indirect and induced job gains and losses at this time, however, because (1) the magnitude of losses and gains is very small at the national level and occur across all states; and (2) the number of job gains during the first three years of the regulation is close to the number of job losses that could occur during the first three years of the regulation. The job gains after the first three years are expected to be approximately 286 jobs per year, without any regulation associated losses. The low magnitude of these gains means that it is highly unlikely that there will be any secondary and induced impacts associated with the proposed regulation.

6.3 Net Effects on Employment

It is difficult to predict overall impacts of the proposed MP&M rule on employment, because the timing and duration of changes in employment depend on a number of factors. In a full-employment economy, unemployment due to plant closures is likely to be short-lived, and the displaced workers are likely to be employed again quickly in other jobs. In less robust economic times, or in locations with substantial local unemployment, unemployment among those laid off from plants that close due to the rule may persist longer.

The timing of the employment created by the rule is more predictable. The rule will create a short-term demand for labor in the early years of implementation, as facilities are required to purchase and install equipment to comply with the rule. The increased employment needed to operate and maintain compliance systems will persist, presumably for the life of the plant.

Table 6.4 provides an estimate of the level and timing of direct impacts of the proposed rule on employment. This estimate assumes that displaced workers are out of work for one year on average, that facilities come into compliance or close over a three year period, and that the requirements to operate and maintain compliance systems continue for 15 years.

The proposed rule would result in a small net decrease in direct employment in each of the first three years of implementation, and then would require 286 FTEs in each year after that. Summing employment each year over the 15 year analysis period indicates that the proposed rule would result in a net increase of 2,575 "FTE-years" in direct labor requirements. Averaged over the 15 year period, this represents a gain of 172 FTEs a year.

Some of the FTEs required to comply with the rule (the annual operating and maintenance requirements and possibly some of the installation labor) will be hired in the same industry sectors that lose employment due to closures. Other FTEs will be gained in industries that supply pollution control equipment to the MP&M industries. EPA does not have specific information on where these equipment manufacturing jobs will occur, but it is likely that some of them will be within the MP&M industries as well, given the nature of compliance equipment. (Waste treatment equipment is often fabricated metal products and machinery.) While it is difficult to determine what the net effect on specific MP&M sectors will be, comparing the estimated annual average net change in FTEs with total employment in the affected industries provides some measure of the potential overall impact of the net impact on direct employment. The average net gain of 172 FTEs equals a negligible percent of total annual employment in the MP&M facilities potentially subject to the rule (water-discharging facilities) and even less compared with total 1996 employment in the industries (SICs) that make up the MP&M industries.[7]

Facilities that remain open and comply with the MP&M regulations are likely to see an increase in their business from closing facilities, assuming no change in demand. This

[5] U.S. Environmental Protection Agency, 1993.

[6] Apogee Research, Inc. 1992.

[7] Total employment in the potentially regulated MP&M facilities is 20,490,006 FTEs, as reported in the Section 308 surveys.

analysis does not take this potential increased business into account in the estimation of job losses and gains. EPA also did not consider the possible effects of excess capacity or underemployment in the equipment manufacturing and installation industries, and assumed that all compliance requirements would result in proportional changes in employment.

Table 6.4: Estimated Direct Net Impacts on Employment over 15 Years, Proposed Rule (number of FTEs per year and total FTE-years)

Year	One-Time Manufacturing & Installation[a]	Annual O&M[a]	Closures[b]	Net Change in Employment
1	1,496	95	1,972	(381)
2	1,496	190	1,972	(286)
3	1,496	286	1,972	(190)
4		286		286
5		286		286
6		286		286
7		286		286
8		286		286
9		286		286
10		286		286
11		286		286
12		286		286
13		286		286
14		286		286
15		286		286
Total FTE-years over 15 years	4,488	4,003	5,916	2,575

a. Assumes that one-third of facilities come into compliance in each of 3 years/
b. Assumes that one-third of the facilities projected to close do so in each of the first 3 years.
Source: U.S. EPA analysis.

GLOSSARY

direct labor requirements: employment losses resulting from lost MP&M output caused by the rule and employment gains caused by compliance expenditures resulting from the rule in the directly-affected industries.

direct requirements coefficients: Bureau of Economic Analysis measure of the dollar value of specific inputs purchased to produce a dollar of a given output.

full-time equivalent (FTE): hours of employment equivalent to one full-time job

FTE-year: one year of full-time employment

indirect labor requirements: changes in employment in industries that supply directly affected industries resulting from increased purchases or reduced output in the directly affected industries.

induced labor requirements: changes in employment in industries providing goods and services to people whose employment is directly or indirectly affected by the rule.

linked industries: industries that sell goods and services to or purchase output from a directly-affected industry.

multiplier: a measure of the change in some aspect of the size of the economy per unit change in employment or spending; in this report, the total changes in employment resulting from a unit change in direct labor requirements.

ACRONYM

FTE: full-time equivalent

REFERENCES

Apogee Research, Inc. 1992. *A Report on Clean Water Investment and Job Creation*, prepared for National Utility Contractors Association.

U.S. Bureau of Labor Statistics. 2000. *Employment Cost Index - Historical Listing*. July 27. http://stats.bls.gov/ecthome.htm.

U.S. Department of Commerce. 1992 and 1997. Bureau of Economic Analysis, *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMSII), Second Edition* and *Third Edition*. Washington, D.C.

U.S. Department of Commerce. 1997. Bureau of Economic Analysis, *The 1992 Benchmark Input-Output Accounts of the United States*.

U.S. Environmental Protection Agency, Office of Water .1993. *Job Creation Fact Sheet*, internal document. February.